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ABSTRACT

This course curriculum is intended for community college instructors and administrators to use in implementing an operating systems course. A student's course syllabus provides this information: credit hours, catalog description, prerequisites, required texts, instructional process, objectives, student evaluation, and class schedule. A student lecture guide consists of a sheet for each of the 22 chapters with contents, chapter objectives, rationale, learning activities, vocabulary, and evaluation. Chapter topics are as follows: introduction; hardware; software and data; linking the components; single- and multiple-user systems; command languages; MS-DOS commands; MS-DOS; UNIX commands and utilities; UNIX internals; libraries and the linkage editor; segmentation, paging, and virtual memory; virtual machines; networks and distributed systems; and database systems. A student lab guide provides this information for each of the 13 assignments: chapter with which the lab assignment is associated, objectives, materials required, laboratory handouts, learning activities, and steps. The instructor's course syllabus outlines prerequisites, required texts, references, required equipment and materials, instructional process, and student evaluation. Competency statements and a course outline are included. The instructor's guide presents this information for each unit: contents, objectives, required equipment and materials, procedures, learning activities, and evaluation. (YLB)

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ED285019



Curriculum Improvement Project

Region II

OPERATING SYSTEMS

Developed by Charlene Wagstaff

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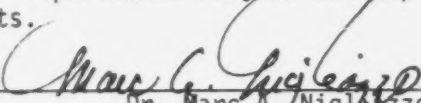
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FOREWORD

Galveston College is not unlike other small community colleges trying to keep its curriculum in sight of rapidly changing technologies. We are unique, however, in that we were given an opportunity by the Coordinating Board of the State of Texas through a grant of Carl D. Perkins Act vocational funds to undertake a major curriculum improvement project which had as its focus curricula for accounting, the allied health professions, microcomputer applications, and office occupations. The course curriculum that you have before you is one of nine courses or modules that were developed from this project. What cannot be immediately evident to you, though, is the sense of cooperation that governed the various phases of the project. The resulting benefits to the College, its faculty, and its staff as a result of this project, were many, including increased knowledge of the curriculum improvement process, increased knowledge of the ramifications of networking microcomputers, increased awareness of the vocational programs of other community colleges, and increased awareness of the need for staff development opportunities. The enduring impact of this project will come in the months ahead as our instructors, and hopefully other instructors across Region II and the state, implement the curricula. We at Galveston College are proud of the results of the Curriculum Improvement Project and hope that your college will share the benefits.



Dr. Marc A. Niglaizzo
Vice President and Dean of Instruction
June 30, 1987

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Copies of the above course curriculum are available for a nominal
cost from: Division of Business and Technology
Galveston College
4015 Avenue Q
Galveston, TX 77550

ACKNOWLEDGMENTS

This course curriculum represents but one of the many final products of the Curriculum Improvement Project. I want to take this opportunity to thank those individuals who worked so hard together to bring this project to a successful conclusion. To the administration and the Board of Regents of Galveston College I wish to express my appreciation for their willingness to accept the challenges and risks associated with a project of this magnitude and for having the forethought to see its benefits for the college and the community. To the support staff in the Business Office and the Office of Planning and Development, thank you for your patience and helpfulness in providing the project staff with everything we needed--yesterday. To Karla Back, Assistant Dean of the Division of Business and Technology, for her constant encouragement of the vision of the project, I will be forever grateful. My most heartfelt thanks, though, go to the project team--all of the curriculum writers who gave 110 percent effort whenever it was needed; the various editors and word processors who helped us along the way; Paul Fama, Research Associate, who provided constancy and consistency; and Mary James, project secretary, who kept us all sane.

Galveston, Texas
June 30, 1987

Cheryl L. Willis, Ph.D.
Project Director

P R E F A C E

The following course curriculum should be used as a resource by fellow instructors and administrators when making decisions about implementing a similar course at their institutions. This course curriculum contains five parts--student's course syllabus, student's lecture guides and student's laboratory guides for each unit of the course, instructor's course syllabus, and instructor's guides for each unit of the course. The materials presented in this course curriculum are only a suggested format for a course of this nature and, as typical with community college curriculum, will undergo revision in the future. The author and Galveston College welcome your comments regarding your experience with these materials.



**STUDENT COURSE
SYLLABUS**

CST 2401: OPERATING SYSTEMS

STUDENT'S COURSE SYLLABUS

COURSE TITLE: OPERATING SYSTEMS

COURSE NUMBER: CST 2401 3 2 4
Prefix No. Lecture Hrs. Lab Hrs. Credit Hrs.

COURSE DESCRIPTION:

An introduction to functional components of a computerized operating system. Topics include system structure, hardware usage, processing levels, resource utilization, scheduling discussions, dispatching, multitasking, and file management.

PREREQUISITES:

CSC 1301 -- Introductory Computing.
CSC 1305 -- Logic and Theory.

TEXT:

Operating Systems: A Systematic View, by William S. Davis, Addison-Wesley Publishing Company, 1987.

Study Guide to Accompany Operating Systems: A Systematic View, by William S. Davis, Addison - Wesley Publishing Company, 1987.

INSTRUCTIONAL PROCESS:

1. Lecture, discussion, and demonstration. Student's Lecture Guides provide outlines of lecture content, objectives, and requirements for each chapter. Students will write definitions for vocabulary words provided in the Student's Lecture Guides.
2. Laboratory assignments will be distributed. Student's Laboratory Guides provide outlines of laboratory assignments, equipment and material required, and steps to follow to complete lab assignments.

3. Tests and quizzes will be given periodically.
4. Homework will be assigned as necessary.

OBJECTIVES:

1. To acquire an understanding of the operating system concepts.
2. To gain an understanding for the problems which might be expected with an operating system.
3. To learn interfacing techniques and common peripherals used in configuring operating systems.
4. To gain expertise in utilizing the PROKEY and SIDEKICK software.
5. To gain expertise in utilizing the MS-DOS and UNIX operating systems.

EVALUATION OF STUDENTS:

Examinations: Three unit exams and a final exam will be given during the semester. NO MAKE-UP EXAMS SHALL BE GIVEN WITHOUT PRIOR APPROVAL.

Quizzes: Quizzes will be administered periodically throughout the semester. NO MAKE-UP QUIZZES WILL BE GIVEN REGARDLESS OF REASON FOR ABSENCE.

Laboratory/
Homework: Assignments will generally be given one week for completion. Late assignments will be accepted for one week after the due date with a 20% reduction in grade. After one week assignments will not be accepted.

GRADE DETERMINATION:

TESTS: Four exams of equal weight (including the mid-term and the final) comprise 50% of the final grade.

QUIZZES: Ten to thirteen quizzes of equal weight comprise 20% of the final grade.

LABS: Five to nine lab assignments of equal weight comprise 30% of the final grade.

CLASS SCHEDULE:

<u>Week</u>	<u>Description</u>	<u>Due</u>	<u>Assignment</u>
1	What is an Operating System? Why Study Operating Systems? An Overview of the Text Assumed Background		Chapter 1
	Main memory The Processor Input and Output Devices Secondary Storage Linking the components	Quiz 1	Chapter 2 Lab #1
2	Hardware and software Software Data	Quiz 2 Lab #1	Chapter 3 Lab #2
3	Linking Internal Components Machine Cycles Architectures Logical and Physical I/O	Quiz 3 Lab #2	Chapter 4 Lab #3
4	The Single-User Environment Communications with the User Communicating with the Hardware The Boot Efficiencies Utilities	TEST 1 Quiz #4 Lab #3	Chapter 5 Lab #4
5	The Multiple-User Environment Multiprogramming Time-Sharing Driving an Operating System	Quiz 5 Lab #4	Chapter 6 Lab #5
6	Command Language Functions Source of Commands Learning Command Language	Quiz 6	Chapter 7 Lab #6

<u>Week</u>	<u>Description</u>	<u>Due</u>	<u>Assignment</u>
7	MS-DOS Getting Started The File System Pipes, Filters, and Redirection Batch Files Other Useful Commands	Quiz 7 Lab #6	Chapter 8 Lab #7
8	TEST II (chapters 5 - 8)	Lab #7	
9	Evaluating an Operating System Microcomputer Operating Systems MS-DOS Internals	Quiz 8	Chapter 14 Lab #8
10	UNIX Logging on The File System Pipes, Filters, and Redirection Shell Scripts Other Useful Commands	Quiz 9 Lab #8	Chapter 9 Lab #9
11	The UNIX SYSTEM Images and Processes The Shell Time-Slicing and Interrupts Memory Management The File System Managing Disk Space Buffering UNIX Internals	Quiz 10 Lab #9	Chapter 16 Lab #10
12	Program Libraries Compilers and Source Statement Libraries Object Modules Load Modules The Loader	Test 2 Quiz 11	Chapter 13 Lab #11
13	Memory Utilization Address Translation Segmentation Paging	Quiz 12 Lab #11	Chapter 15 Lab #12

Segmentation and Paging Virtual Memory			
<u>Week</u>	<u>Description</u>	<u>Due</u>	<u>Assignment</u>
14	Operating System Development VM's Structure The Control Program A New Standard	Quiz 13 Lab #12	Chapter 20
15	Why Distributed Systems? Data Communication Communications with a Single Mainframe Networks	Quiz 14 Lab #5	Chapter 21 Lab #13
16	The Evolution of System Software Traditional Data Management The Central Data Base Approach Software Migration	Quiz 15 Lab #13	Chapter 22
17	FINAL EXAM (50% from chapters 1 - 8, and 50% from chapters 13 - 16, 20 - 22)		



STUDENT LECTURE GUIDE

CST 2401: OPERATING SYSTEMS

STUDENT'S LECTURE GUIDE

Chapter 1

CHAPTER TITLE: Introduction to Operating Systems.

CONTENTS OF CHAPTER:

1. What is an Operating System?
2. Why Study Operating Systems?
3. An Overview of the Text.
4. Assumed Background.

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Define an operating system.
2. Describe why operating systems are studied.

RATIONALE:

Students must understand the need of studying microcomputer operating systems to utilize the system to its fullest.

LEARNING ACTIVITIES:

Read Chapter 1 in text
Answer Chapter 1 questions in Study Guide

CHAPTER EVALUATION:

None

TERMS (vocabulary):

None

CST 2401: OPERATING SYSTEMS

STUDENT'S LECTURE GUIDE

Chapter 2

CHAPTER TITLE: Hardware.

CONTENTS OF CHAPTER:

1. Main Memory.
 - A. Physical Memory Devices.
 - B. Addressing Memory.
2. The Processor.
 - A. Machine cycles.
3. Input and output devices.
4. Secondary storage.
 - A. Diskette.
 - B. Hard Disk.
 - C. Other secondary media.
 - D. Accessing secondary storage.
5. Linking the components.

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the internal manipulations of binary data and instructions.
2. Identify the types of physical memory and their components.
3. Describe addressing techniques in main memory.
4. Identify and define the components of the processor.
5. Describe the processes within a machine cycle.
6. Identify and describe the purpose of registers.

RATIONALE:

It is necessary for the student to understand how the operating system interfaces between the processor and the secondary storage media.

LEARNING ACTIVITIES:

Read Chapter 2

Answer the questions in Chapter 2 of the Study Guide

CHAPTER EVALUATION:

Quiz #1

TERMS (vocabulary):

address	directory	I-time
arithmetic &	disk	machine cycle
logic unit	diskette	main memory
backup	E-time	output
bit	hard disk	processor
buffer	input	program
channel	instruction	register
clock	instruction	secondary storage
control unit	control unit	word
(I/O)		

STUDENT'S LECTURE GUIDE

Chapter 3

CHAPTER TITLE: Software and Data.

CONTENTS OF CHAPTER:

1. Hardware and Software.
2. Software.
 - A. Instructions.
 - B. Programming Languages.
 - C. Libraries.
 - D. Reentrant Code.
3. Data.
 - A. Data Management.
 - B. Data Elements.
 - C. Data Structures.
 - D. Access Techniques.
 - E. Data Base Management.

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Describe the parts of an instruction.
2. Distinguish among an assembler, a compiler, and an interpreter.
3. Define a library and its purposes.
4. Distinguish among a source module, an object module, and a load module.
5. Describe the different types of data elements.
6. Describe the different types of data structures.
7. Define the relative record concept.
8. Distinguish between sequential and direct access.
9. Define a data base and state its uses.

RATIONALE:

Students must be able to define and understand how instructions are translated by interpreters, compilers, and assemblers then combines them to form a load module through the linkage editor.

LEARNING ACTIVITIES:

Read Chapter 3 of text
Answer the Chapter 3 questions from the Study Guide

CHAPTER EVALUATION:

Quiz #2

TERMS (vocabulary):

assembler language	instruction	object code
compiler	interpreter	operand
data access	library	operation code
data element	linkage editor	program
data management	load module	reentrant
data structure	loader	relative record
data base	machine language	number
file	nonprocedural	source code
	language	

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Chapter 4

CHAPTER TITLE: Linking the Components.

CONTENTS OF CHAPTER:

1. Linking Internal Components.
 - A. Bus Lines.
 - B. Word Size.
2. Machine Cycles.
3. Architectures.
 - A. Single-Bus Architecture.
 - B. Interfaces.
 - C. Channels and Control Units.
 - D. Multiple-Bus Architecture.
4. Logical and Physical I/O.
 - A. Primitives.
 - B. Open.
 - C. Accessing Data.

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe how the internal components of a computer are physically linked.
2. Describe how the word size affects the processing speed, precision, memory capacity, and instruction set size.
3. Describe a motherboard, a slot, and a bus.
4. Distinguish between single-bus and multiple-bus architecture.
5. Define a primitive operation.
6. Distinguish between logical and physical I/O.

RATIONALE:

Since the internal components are designed around a standard word size, the student must understand how it affects the computer's speed, memory capacity, processor, instruction set size, and cost.

LEARNING ACTIVITIES:

Read Chapter 4 of text
Answer the Chapter 4 questions from Study Guide

CHAPTER EVALUATION:

Quiz #3

TERMS (vocabulary):

access method
architecture
bus
channel
channel program
command

control unit
interface
interrupt
logical I/O
machine cycle
multiple-bus
architecture

open
physical I/O
primitive
single-bus
architecture
word

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Chapter 5

CHAPTER TITLE: Single-user Systems

CONTENTS OF CHAPTER:

1. The Single-User Environment
2. Communicating with the User
 - A. The Command Processor
 - B. The Command Language
 - C. Shells
3. Communicating with the Hardware
 - A. The Input/Output Control System
 - B. The File System
 - C. Memory Allocation
 - D. Interrupts
4. The Boot
5. Efficiencies
 - A. Speed Disparity
 - B. Scheduling
 - C. Other Run-Time Savings
6. Utilities

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the single-user environment.
2. Define the three common modules: the command processor, the I/O control system, and the file system.
3. Define a command language.
4. Define a batch command file.
5. Distinguish between a standard shell and a custom shell.
6. Define the functions of the I/O control system.
7. Define the functions of the file system.
8. Distinguish between resident and transient modules.
9. Define overlay structures.

10. Define interrupt, boot, and speed disparity.
11. Define multiple buffering.
12. Describe the function of utilities.

RATIONALE:

Students must understand how the command processor accepts, interprets, and carries out commands.

LEARNING ACTIVITIES:

Read Chapter 5 of text
Answer Chapter 5 questions of the Study Guide

CHAPTER EVALUATION:

Quiz #4

TERMS (vocabulary):

batch file	input/output	protocol
blocking	control system	resident
boot	interrupt	resource
checkpoint	IOCS	management
close	logical I/O	scheduling
command driven	multiple buffering	setup
command language	open	shell
command processor	physical I/O	speed disparity
file system	pointer	transient
	primitive command	transient area
		utility

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Chapter 6

CHAPTER TITLE: Multiple-user Systems

CONTENTS OF CHAPTER:

1. The Multiple-User Environment
2. Multiprogramming
 - A. Memory Management
 - B. Managing Processor Time
 - C. Interrupts
 - D. Peripheral Device Allocation
 - E. Scheduling and Queuing
 - F. Spooling
 - G. A Multiprogramming Operating System
3. Time-Sharing
 - A. Roll-in/Roll-out
 - B. Time-Slicing
 - C. Time-Sharing and Interrupts
 - D. Allocating External Devices
 - E. External Priority
4. Driving an Operating System

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Describe the effectiveness of the pool-driven time-sharing operating system and the interrupt-driven multiprogramming operating system.
2. Distinguish among the four types of memory management: fixed-partition, dynamic, segmentation, and paging.
3. Explain how the queuing routines and the scheduler work together to load application programs.
4. Define throughput and turnaround time.

RATIONALE:

The student must be able to define and understand the various types of memory management in order to design an effective multiprogramming system.

LEARNING ACTIVITIES:

Read Chapter 6 of text
Answer Chapter 6 questions of Study Guide

CHAPTER EVALUATION:

Quiz #5

TERMS (vocabulary):

background	fragmentation	roll-in
control block	interrupt	roll-out
deadlock	interrupt handler	scheduler
dispatcher	multiprogramming	segment
dynamic memory	page	spooling
management	partition	throughput
fixed-partition	polling	time-sharing
memory	queuing	time-slicing
management	region	turnaround
foreground	response time	virtual memory

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Chapter 7

CHAPTER TITLE:: Command Languages

CONTENTS OF CHAPTER:

1. Command Language Functions
 - A. Identifying Users
 - B. Identifying Programs
 - C. Specifying Device Requirements
 - D. Run-Time Intervention
2. Sources of Commands
3. Learning Command Language

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Distinguish between interactive and batch commands.
2. Define the command language functions.

RATIONALE:

It is necessary for the student to distinguish between interactive and batch commands to utilize a microcomputer effectively.

LEARNING ACTIVITIES:

Read Chapter 7 of text
Answer Chapter 7 questions of the Study Guide

CHAPTER EVALUATION:

Quiz #6

TERMS (vocabulary):

command

job control language

job stream

STUDENT'S LECTURE GUIDE

Chapter 8

CHAPTER TITLE: MS-DOS Commands

CONTENTS OF CHAPTER:

1. MS-DOS
2. Getting Started
 - A. Formatting a Disk
3. The File System
 - A. File Names
 - B. Directories
 - C. Path Names
 - D. Viewing a Directory
 - E. Creating Directories
 - F. Creating Files
 - G. Changing Directories
 - H. Manipulating Files
4. Pipes, Filters, and Redirection
5. Batch Files
6. Other Useful Commands

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Describe the general form of an MS-DOS command.
2. Format a floppy disk.
3. Distinguish between the two types of directory structures: simple linear and hierarchial.
4. Distinguish between a path name and a file name.
5. Distinguish between a root directory and a working directory.
6. Define redirection and state its uses.
7. Describe the functions of filters and pipes.
8. Create an AUTOEXEC.BAT file.

LEARNING ACTIVITIES:

Read Chapter 8 of text
Answer Chapter 8 questions from Study Guide

RATIONALE:

Students must be able to define and understand the MS-DOS command language in creating and maintaining directories and batch files.

CHAPTER EVALUATION:

Quiz #7

TERMS (vocabulary):

batch file	file name	root directory
boot	filter	SORT
CHDIR	FORMAT	subdirectory
CHKDSK	MKDIR	TIME
command	MORE	transient
COPY	parameter	TREE
DATE	path name	TYPE
default drive	pipe	VER
delimiter	prompt	wild card
DIR	redirection	working directory
directory	resident	

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STUDENT'S LECTURE GUIDE

Chapter 14

CHAPTER TITLE: MS-DOS

CONTENTS OF CHAPTER:

1. Evaluating an Operating System
 - A. Measures of Effectiveness
 - B. System Objectives
2. Microcomputer Operating Systems
 - A. The Microcomputer Environment
 - B. Basic Operating System Functions
3. MS-DOS Internals
 - A. The Shell
 - B. Accessing Peripherals
 - C. The File System
 - D. Interrupt Processing
 - E. Booting MS-DOS
 - F. Running MS-DOS

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Describe the hardware environment of a typical microcomputer system.
2. Describe the criteria for measuring the effectiveness of a micro.
3. Relate the functions of COMMAND.COM to the general function of a command processor or shell.
4. Describe the functions of IO.SYS and MSDOS.SYS.
5. Define a device driver.
6. Define an interrupt.

RATIONALE:

The student must be able to define and understand the components and functions of the MS-DOS operating system: the command processor, the I/O control system, and the file system.

LEARNING ACTIVITIES:

Read Chapter 14 of text
Answer Chapter 14 questions of Study Guide

CHAPTER EVALUATION:

Quiz #8

TERMS (vocabulary):

boot	input/output control system	MSDOS.SYS
cluster	interrupt	nucleus
command processor	interrupt vector	PC-DOS
COMMAND.COM	interrrupt vector table	resident
device driver	IOCS	shell
file allocation table	IO.SYS	supervisor
file system	kernal	transient
		transient
		area

STUDENT'S LECTURE GUIDE

Chapter 9

CHAPTER TITLE: UNIX Commands and Utilities

CONTENTS OF CHAPTER:

1. UNIX
2. Logging On
3. The File System
 - A. File Names
 - B. Directories
 - C. Pathnames
 - D. Viewing a Directory
 - E. Creating Directories
 - F. Changing Working Directories
 - G. Creating Files
 - H. Manipulating Files
4. Pipes, Filters, and Redirection
5. Shell Scripts
6. Other Useful Commands

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the general form of a UNIX command.
2. Distinguish between the MS-DOS and the UNIX operating systems.
3. Compare a shell script to an MS-DOS batch file.
4. Distinguish between the two types of directory structures: simple linear and hierarchial.
5. Distinguish between a path name and a file name.
6. Distinguish between the root directory and a working directory.
7. Describe the functions of redirection.
8. Describe the functions of filters and pipes.

RATIONALE:

Students must be able to define and understand the UNIX command language in creating and maintaining directories and batch files in order to make efficient use of microcomputer in the UNIX environment.

LEARNING ACTIVITIES:

Read Chapter 9 of text
Answer Chapter 9 questions of Study Guide

CHAPTER EVALUATION:

Quiz #9

TERMS (vocabulary):

background	filter	prompt
Bourne shell	home directory	redirection
C shell	invisible file	root directory
cat	login name	shell
cd	ls	shell script
cp	mkdir	sort
date	password	vi
directory	passwd	who
extension	pathname	wild card
file name	pipe	working directory
file system		

STUDENT'S LECTURE GUIDE

Chapter 16

CHAPTER TITLE: UNIX Internals

CONTENTS OF CHAPTER:

1. The UNIX System
2. Images and Processes
 - A. Process Creation
 - B. Initialization
 - C. Process Management
3. The Shell
4. Time-Slicing and Interrupts
5. Memory Management
 - A. Swapping (or paging)
 - B. Memory Space and Reentrant Code
6. The File System
 - A. Accessing Disk Files
7. Managing Disk Space
8. Buffering
9. UNIX Internals

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Define shell and kernel.
2. Describe the portability of UNIX.
3. Distinguish between an image and a process.
4. Explain how processes are created under UNIX.
5. Describe fork primitive creation and its varied results.
6. Explain UNIX dispatching.
7. Distinguish between an event and a process.
8. Explain the linking process between UNIX and a peripheral device.

LEARNING ACTIVITIES:

Read Chapter 16 of text
Answer Chapter 16 questions from Study Guide

RATIONALE:

The student must be able to define and understand the components of the UNIX operating system: the command processor, the I/O control system, and the file system.

CHAPTER EVALUATION:

Quiz #10

TERMS (vocabulary):

block device	file descriptor	process table
buffer pool	file system	pseudocomputer
character device	fork	shell
child	i-list	signal
configuration table	image	stack segment
data segment	init	super block
device driver	i-node	swapping
device number	i-node table	system data
event	i-number	segment
event-wait	kernal	system file table
exec	parent	text segment
exit	process	text table
process file table	wait	

STUDENT'S LECTURE GUIDE

Chapter 13

CHAPTER TITLE: Libraries and the Linkage Editor

CONTENTS OF CHAPTER:

1. Program Libraries
 - A. Compile, Link, Edit, and Execute
2. Compilers and Source Statement Libraries
 - A. Creating a Library
 - B. Adding Members to a Library
 - C. Using Private Source Statement Libraries
3. Object Modules
 - A. Creating an Object Module Library
 - B. Adding Object Modules to a Library
4. Load Modules
 - A. The Linkage Editor
 - B. The Primary Object Module
 - C. System Libraries
 - D. Private Libraries
 - E. Load Module Libraries
5. The Loader

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Explain how a compiler or an assembler incorporates source statement library members into a source module.
2. Distinguish between a system library and a private library.
3. Describe the purpose of the linkage editor.

RATIONALE:

It is necessary for the student to gain an understanding of the compilation, link editing, and execution sequence before the function of the object and source modules can be grasped.

LEARNING ACTIVITIES:

Read Chapter 13 of text
Answer Chapter 13 questions of Study Guide

CHAPTER EVALUATION:

Quiz #11

TERMS (vocabulary):

directory	load module	partitioned data set
external reference	load module library	source module
external symbol	loader	source statement
library		
dictionary	macro	SYSGO
IEBGENER	member	SYSLIB
IEFBR14	object module	SYSLIN
INCLUDE	library	SYSLMOD
library		
linkage editor		

STUDENT'S LECTURE GUIDE

Chapter 15

CHAPTER TITLE: Segmentation, Paging, and Virtual Memory

CONTENTS OF CHAPTER:

1. Memory Utilization
2. Address Translation
3. Segmentation
 - A. Translating Segment Addresses
 - B. Addressing the Operating System
 - C. Segmentation and Memory Management
4. Paging
 - A. Paging and Memory Management
5. Segmentation and Paging
6. Virtual Memory
 - A. Addressing Virtual Memory
 - B. Virtual-Equals-Real Area
 - C. Thrashing
 - D. Implementing Virtual Memory
 - E. Why Virtual Memory?

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Distinguish fixed-partition memory management, dynamic memory management, segmentation, paging, and virtual memory.
2. Distinguish between relative and absolute addresses.
3. Explain address translation.
4. Explain segmentation and dynamic translation.
5. Explain how memory space is managed under segmentation.
6. Explain paging.
7. Explain how main memory space is managed under paging.
8. Discuss the advantages and disadvantages associated with segmentation, paging, and segmentation and paging.
9. Explain virtual memory.

10. Distinguish between virtual and real addresses.
11. Distinguish between demand paging and prepaging.
12. Explain the significance of the virtual-equals-real area.
13. Explain thrashing.
14. Describe how virtual memory systems are physically implemented.
15. Explain how virtual memory serves as a model of a complex address space.

RATIONALE:

Students must understand mainframe and microcomputer memory management in order to compare and contrast the similarities and differences when networking the two types of computers together.

LEARNING ACTIVITIES:

Read Chapter 15 in text
Answer Chapter 15 questions in Study Guide

CHAPTER EVALUATION:

Quiz #12

TERMS (vocabulary):

absolute address	page fault	segment table
address translation	page frame table	segment table
base-plus-displacement	page pool	location register
demand paging	page table	segmentation
dynamic address	page table	segmentation and
translation	location register	paging
external paging	paging	thrashing
device	prepaging	virtual-equals-real
page address	real memory	area
registers	relative address	virtual memory

CST 2401: OPERATING SYSTEMS

STUDENT'S LECTURE GUIDE

Chapter 20

CHAPTER TITLE: Virtual Machines

CONTENTS OF CHAPTER:

1. Operating System Development
 - A. The Virtual Machine Concept
 - B. VM/SP
2. VM's Structure
 - A. CMS
3. The Control Program (CP)
 - A. Processor Management
 - B. Memory Management
 - C. Managing Peripheral Devices
 - D. Principles of Operation
4. A New Standard

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the ideal program development environment.
2. Explain the virtual machine concept.
3. Explain transparency.
4. Explain why IBM developed VM/SP.
5. Distinguish between a real operating system and a virtual operating system.
6. Briefly describe the structure of a VM system.
7. Explain how the control program simulates the operation of a real computer for its virtual operating systems.
8. Describe the functions performed by CMS.
9. Explain how CP manages processor time and allocates main memory space.
10. Explain how CP manages access to peripheral devices.
11. Explain the minidisk concept.
12. Briefly describe the control program's principles of operation.
13. Discuss the advantages and disadvantages of VM.

RATIONALE:

Students must understand the differences between the virtual and real operating system in conjunction with the control program in order to enhance their knowledge when networking with mainframe and microcomputers.

LEARNING ACTIVITIES:

Read Chapter 20 in text
Answer Chapter 20 questions in Study Guide

CHAPTER EVALUATION:

Quiz #13

TERMS (vocabulary):

CMS
control program
conversational
monitor
system
CP
minidisk

real computer
system directory
transparent
virtual machine
virtual operating
system

virtual peripheral
devices
VM/SP

STUDENT'S LECTURE GUIDE

Chapter 21

CHAPTER TITLE: Networks and Distributed Systems

CONTENTS OF CHAPTER:

1. Why Distributed Systems?
2. Data Communication
 - A. Analog and Digital
 - B. Communication Media
 - C. Switching
 - D. Protocols
3. Communicating with a Single Mainframe
4. Networks
 - A. Network Configurations
 - B. Network Operating Systems
 - C. The Future of Networks

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Define a network.
2. Distinguish between local and remote data communication.
3. Distinguish between analog and digital data.
4. Describe circuit switching, message switching, and packet switching.
5. Define a protocol.
6. Distinguish between computer networks and local area networks.
7. Distinguish among the four types of networks: hierarchical, star, ring, and multiple-user bus.
8. Distinguish between distributed and network operating systems.

RATIONALE:

The student must be able to define and understand the function of networks in conjunction with the operating system.

LEARNING ACTIVITIES:

Read Chapter 21 of text
Answer Chapter 21 questions from Study Guide

CHAPTER EVALUATION:

Quiz #14

TERMS (vocabulary):

agent process	host	network operating
collision detection	LAN	system
computation migration	line	partition
computer network	local	management
data communication monitor	local area	polling
data migration	network	protocol
distributed operating system	message slot	remote
multiple-access bus	network	ring network
star network	token passing	

STUDENT'S LECTURE GUIDE

Chapter 22

CHAPTER TITLE: Data Base Systems

CONTENTS OF CHAPTER:

1. The Evolution of System Software
2. Traditional Data Management
 - A. Custom Files
 - B. Data Redundancy
 - C. Data Ownership
 - D. Data Dependency
3. The Central Data Base Approach
 - A. Data Integrity
 - B. Data as a Resource
 - C. Data-Independent Software
 - D. Advantages and Disadvantages
4. Implementing a Data Base
 - A. Data Base Organization
 - B. The Data Base Management System
5. Software Migration

CHAPTER OBJECTIVES: Upon completion of this chapter the student will be able to:

1. Describe how data redundancy affects data integrity.
2. Describe how a data base minimizes data dependency.
3. Explain the functions of a well-designed data base.
4. Explain how pointers and indexes are used to line the elements in a data base.

RATIONALE:

It is necessary for the student to define and understand the functions of data bases in conjunction with operating systems in order to eliminate file redundancy and increase internal efficiency.

LEARNING ACTIVITIES:

Read Chapter 22 of text
Answer Chapter 22 questions from Study Guide

CHAPTER EVALUATION:

Quiz #15

TERMS (vocabulary):

data accessibility
data base
data base administrator
data base management system
data dependency

data integrity
data redundancy
hierarchial data base
network data base
relational data base



STUDENT LAB GUIDE

CST 2401: OPERATING SYSTEMS

Student's Laboratory Guide

Assignment #1

UNIT TITLE: Preparing a Fixed Disk

ASSIGNMENT IS ASSOCIATED

WITH: HARDWARE (Chapter 2)

TIME REQUIRED: 1 Hour

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Prepare a fixed disk.
2. Partition a fixed disk.

MATERIALS REQUIRED:

Text
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS diskette

LABORATORY HANDOUTS:

1. Sections from the DOS reference manual on preparing fixed disks.

LEARNING ACTIVITIES (assignments):

1. Learn the steps required in preparing a fixed disk.
2. Learn the steps required for partitioning and displaying disk contents.

STEPS

1. Put your MS-DOS diskette in DRIVE A.
2. Ensure that FDISK.COM is on the MS-DOS diskette.

3. Type: d:FDISK <enter>.
4. A selection menu will appear on your screen:
 - 1 - create partition;
 - 2 - change active partition;
 - 3 - delete partition;
 - 4 - display partition data;
 - 5 - select next fixed disk drive.Type: 1 <enter>.
5. A message will appear requesting:
DO YOU WISH TO USE THE ENTIRE FIXED DISK FOR
DOS (Y,N)?
Type: Y <enter>.
6. Insert your DOS diskette in DRIVE A, then
press any key to continue.
7. Type: fFORMAT d: /S/V <enter>.
8. Press any key to begin the formatting.
9. Key in the volume name when prompted:
VOLUME LABEL (11 CHARACTERS, ENTER for none)?
10. With your DOS diskette still in DRIVE "A",
Type: COPY *.* d:.
11. Remove the DOS diskette from DRIVE "A" (leave
the diskette drive door open) and press the
CTRL, ALT, and DEL keys simultaneously.
12. DOS will now start from the fixed disk you
have just created.
13. Press the ESC key to return to the "seletion
menu".
14. Type: 4 <enter>.
15. The partition data information will now be
displayed on the screen.
16. Print the partition information.

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Assignment #2

UNIT TITLE: Using the NOTEPAD and CALCULATOR options of
SIDEKICK

ASSIGNMENT IS ASSOCIATED
WITH: SOFTWARE (Chapter 3)

TIME REQUIRED: 2 Hours

OBJECTIVES: Upon completion of this lab, the student will
be able to:

1. Use the SIDEKICK features of NOTEPAD and CALCULATOR in conjunction with a word processor.
2. Perform number conversion from decimal to hexadecimal or binary.

EQUIPMENT AND MATERIALS REQUIRED:

Text
SIDEKICK manual or handouts
Arithmetic worksheet
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS diskette

LABORATORY HANDOUTS:

1. Sections from SIDEKICK manual on NOTEPAD and CALCULATOR.
2. Arithmetic worksheet (attached).

LEARNING ACTIVITIES (assignments):

1. Read information on SIDEKICK.
2. Perform the calculations from the arithmetic handout manually to verify results obtained with SIDEKICK.
3. Use CALCULATOR to perform the binary and hexadecimal conversions.
4. Print the results.

STEPS:

1. Load SIDEKICK software.
2. Invoke the NOTEPAD utility by pressing ALT-N.
3. Key in the text from the ARITHMETIC WORKSHEET and save.
4. Invoke the CALCULATOR utility by pressing ALT-C.
5. Press either D (decimal), H (hexadecimal), or B (binary) for the correct arithmetic conversions.
6. Press ESC to return to NOTEPAD then record results.
7. Print the NOTEPAD results.

NAME _____

DATE _____

CST 2401: OPERATING SYSTEMS
ARITHMETIC WORKSHEET
SIDEKICK

This assignment utilizes the RAM resident program "SIDEKICK" with the NOTEPAD and CALCULATOR options to construct text and make number conversions from decimal to hexadecimal and from decimal to binary.

PART I. Use the CALCULATOR function to convert the numbers and equations below from decimal to binary. Record the binary result.

- | | | | |
|--------------|---------|---------------------------|---------|
| 1. 5 | = _____ | 6. $16 * 8$ | = _____ |
| 2. 13 | = _____ | 7. $4 * (6 / 2) + 3$ | = _____ |
| 3. $108 / 6$ | = _____ | 8. $(43 / (6 + 9)) + 7$ | = _____ |
| 4. $21 / 7$ | = _____ | 9. $(12 * 3) * (6 + 4)$ | = _____ |
| 5. $8 * 4$ | = _____ | 10. $(23 / 4) + (19 / 6)$ | = _____ |

PART II. Use the CALCULATOR function to convert the numbers and equations below from decimal to hexadecimal. Record the hexadecimal result.

- | | | | |
|-------------|---------|--------------------------|---------|
| 1. 4 | = _____ | 6. $18 / 3$ | = _____ |
| 2. 16 | = _____ | 7. $4 * (6 / 2) - 8$ | = _____ |
| 3. $7 + 7$ | = _____ | 8. $(56 / 9 + 6)$ | = _____ |
| 4. $12 - 3$ | = _____ | 9. $(94 / 7) - (28 / 3)$ | = _____ |
| 5. $5 * 6$ | = _____ | 10. $(17 + 9) / (8 * 9)$ | = _____ |

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STUDENT'S LABORATORY GUIDE

Assignment #3

UNIT TITLE: Investigating the Internal Components

ASSIGNMENT IS ASSOCIATED

WITH: Linking the Components (Chapter 4)

TIME REQUIRED: 2 hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Identify the basic internal components of a microcomputer.
2. Demonstrate how the components are linked through bus lines.

MATERIALS REQUIRED:

Text
PC manual or handouts on machine components
Microcomputer with 640K and two disk drives without monitor
Screwdriver
Template

LABORATORY HANDOUTS:

1. Information on the site microcomputers.

LEARNING ACTIVITIES:

1. Read manual or handouts pertaining to the internal components of the site microcomputers.
2. Investigate the internal components of the microcomputer and establish how they are linked together.
3. Draw your findings on plain white paper, such as typing paper, with a template. Label the components and what circuit boards or devices to which they are connected.

STEPS:

1. Read the section of the microcomputer reference manual on the internal components.
2. Remove the cover from the microcomputer set aside in the lab for this exercise.
3. Identify the function performed by each circuit board -- use identification numbers or labels provided by the instructor.
4. Locate and follow the external bus lines to establish how the components are linked.
5. Sketch the internal components on plain white paper using a template, showing how the components are linked.
6. Replace cover.

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Assignment #4

UNIT TITLE: Using the ASCII table and DEBUG FEATURES

ASSIGNMENT IS ASSOCIATED

WITH: Single-User Systems (Chapter 5)

TIME REQUIRED: 2 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Use the SIDEKICK feature of ASCII TABLE in conjunction with a the DEBUG utility of the operating system.
2. Perform number conversion from decimal to hexadecimal or binary.

MATERIALS REQUIRED:

Text
SIDEKICK manual or handouts
Microcomputer with 640K with two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS diskette
SIDEKICK diskette

LABORATORY HANDOUTS:

1. Sections from SIDEKICK manual on ASCII TABLE.
2. Sections from MS-DOS manual on DEBUG.

LEARNING ACTIVITIES (assignments):

1. Read the information on the ASCII TABLE option of SIDEKICK.
2. Read the information on the DEBUG feature of MS-DOS.
3. Write the program specified in either BASIC or PASCAL.
4. Use SIDEKICK and DEBUG to complete the assignment.

STEPS:

1. Write a simple BASIC or PASCAL program to print or display your name, address, city, state, and zip.
2. Save the program on your work disk.
3. Load SIDEKICK.
4. Use the operating system's DEBUG feature to search your program for the hexadecimal address of the following items:
 - A. Your first name;
 - B. Your street name;
 - C. Your zip code.
5. Press CNTL-ALT to invoke SIDEKICK.
6. Press ALT-A to invoke the ASCII TABLE feature and convert the addresses of the above items.
7. Print the results.

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Assignment #5

UNIT TITLE: Configuring PROKEY in conjunction with a word processor

ASSIGNMENT IS ASSOCIATED WITH : Multiple-User Systems (Chapter 6)

TIME REQUIRED: 5 - 7 hours

OBJECTIVES: The student should be able to:

1. Load the PROKEY software and follow the tutorial.
2. Write a college-level paper on some phase of operating systems -- must have instructor approval.
3. Use a word processor in conjunction with PROKEY to write the paper.
4. Create PROKEY macros which reconfigure the F1 through F10 function keys on the microcomputer's keyboard.

MATERIALS REQUIRED:

Text
PROKEY manual or handouts
Word processor manual or handouts
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS diskette
PROKEY diskette
Word processor such as WORDSTAR or MULTIMATE

LABORATORY HANDOUTS:

1. Copy of APA research standards located in library.
2. Copy of PROKEY manual or handouts from manual on macros.
3. Copy of the word processor commands.

LEARNING ACTIVITIES (assignments):

1. Read the information on PROKEY.

2. Load PROKEY and conduct the TOUR before engaging PROKEY to key in your research paper.
3. Conduct research in the library on an OPERATING SYSTEMS topic approved by your instructor.
4. Reconfigure the FUNCTION keys with PROKEY.
5. Key in your report.

The paper must be at least three typed, double-spaced pages on continuous form of standard paper (8 1/2 by 11 inches). The paper must include at least five references from either periodicals and/or books referenced according to APA standards.

STEPS:

PHASE I.

1. Load MS-DOS.
2. Load PROKEY.
3. Invoke the PROKEY TOUR and follow the commands.

PHASE II.

1. Load your word processor.
2. Get into EDIT mode for a document to create the following macros for redefinition of:
 - F1 to save the text and resume;
 - F2 to save the text and exit to system;
 - F3 to save the text and exit the edit mode;
 - F4 to quit edit and abandon file;
 - F6 to print your report heading in boldface type;
 - F7 to move the cursor to the top of the report;
 - F8 to move the cursor to the bottom of the report;
 - F9 & F10 programmer's discretion.
3. Save the file and return to the word processor to enter your report.
4. Print your file containing the macros and your report.
5. Turn in your disk containing the report and macros.

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Assignment #6

UNIT TITLE: Exploring the MS-DOS disk

ASSIGNMENT IS ASSOCIATED

WITH: Command Languages (Chapter 7)

TIME REQUIRED: 2 hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Understand and utilize the MS-DOS utility features.

EQUIPMENT AND MATERIALS REQUIRED:

Text
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
Norton Utilities Software
MS-DOS software

LABORATORY HANDOUTS:

1. Instructions on the use of NORTON UTILITIES.

LEARNING ACTIVITIES (assignments):

1. Read the information on the Utility package.
2. Load and follow the tutorial.

STEPS:

1. Read instructions on the Utility Package.
2. Load the Utility with "DL" (DiskLook).
3. Follow instructions on the tutorial.

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Assignment #7

UNIT TITLE: Creating and manipulating MS-DOS directories

ASSIGNMENT IS ASSOCIATED

WITH: MS-DOS Commands (Chapter 8)

TIME REQUIRED: 2 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Create a tree directory complete with subdirectories and files.
2. Use the CHDIR to alternate between directories.
3. Add and delete subdirectories.
4. Add and delete files within subdirectories.
5. Trace a path within a subdirectory.

MATERIALS REQUIRED:

Text
MS-DOS manual
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS diskette

LABORATORY HANDOUTS:

1. Copy of DIRECTORY commands.

LEARNING ACTIVITIES (assignments):

1. Load MS-DOS.
2. Add and delete files and subdirectories from the tree.
3. Print results at specified times.
4. Draw the final status of the tree on plain white paper.

STEPS:

1. Load MS-DOS into the microcomputer.
2. Create the following files (without data):

TEST1	MIDTERM	TEST3	LAB5
LAB1	LAB2	QUIZ5	TEST4
QUIZ1	LAB3	FINAL	QUIZ6
QUIZ2	QUIZ3	LAB4	LAB6
POP1	POP3	LAB7	POP1

3. Create the following subdirectories:

EXAMS QUIZES LABS

4. Display and print the directory.
5. Place TEST1, MIDTERM, TEST3, and TEST4 under the EXAMS subdirectory.
6. Place LAB1 and LAB2 under the LABS subdirectory.
7. Place QUIZ1, QUIZ2, POP1, and QUIZ3 under the QUIZES subdirectory.
8. Display and print the contents of the directory.
9. Issue a TREE command and print the contents of all subdirectories.
10. Place LAB3, LAB4, and LAB5 under the LABS subdirectory.
11. Remove TEST4 from the EXAMS subdirectory.
12. Place QUIZ5 and QUIZ6 under the QUIZES subdirectory.
13. Place FINAL under the EXAMS subdirectory.
14. Place LAB7 under the LABS subdirectory.
15. Place POP2 and POP3 under the EXAMS subdirectory.
16. Place LAB3 and LAB6 under the LABS subdirectory.
17. Describe the results of #16 and correct.
18. Move POP2 and POP3 to the QUIZES subdirectory.
19. Display and print the contents of the TREE.
20. Illustrate the completed TREE on a separate page.

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Assignment #8

UNIT TITLE: Creating and Running Batch Files

ASSIGNMENT IS ASSOCIATED

WITH: MS-DOS (Chapter 14)

TIME REQUIRED: 2 - 4 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Create either PASCAL or BASIC programs to be run in a BATCH environment.
2. Create BATCH MACROS.
3. Run a student-created batch file.

MATERIALS REQUIRED:

Text
MS-DOS manual
Microcomputer with 640K and disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS operating system

LABORATORY HANDOUTS:

1. Copy of DIRECTORY commands from manual.
2. Copy of Batch file notes from manual.

LEARNING ACTIVITIES (assignments):

1. Write the BASIC or PASCAL program according to the specifications.
2. Set up the BATCH file and EXECUTE the BATCH file.
3. Turn in the program, the BATCH file instructions, and a copy of the screen during execution.

STEPS:

1. Create a non-sequenced input disk file of 20 items that contains the following information:
 - A. Social Security Number -- 9 positions;
 - B. Five Lab Grades -- 3 positions each;
 - C. Four Test Grades -- 3 positions each.
2. Write a BASIC or PASCAL program that will input 20 data items from the newly created file which will accomplish the following tasks:
 - A. Calculate an overall lab average, test average, and overall grade for each student (lab = 50% and tests = 50%).
 - B. Print the Social Security Number, lab average, test average, and overall grade on a formatted report.
 - C. Write the information in "B" to disk.
3. Create and run a BATCH FILE that accomplish the following tasks:
 - A. Display the current date and time;
 - B. Display text on the screen explaining the purpose of the batch file using REM commands.
 - C. Use the PAUSE command to ensure that the operator has the correct disks in the drives.
 - D. Sort the contents of the output disk file on social security number using the MS-DOS SORT command with either redirection or pipelines.
 - E. Print the contents of the disk file after the sort.

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Assignment #9

UNIT TITLE: Creating and Manipulating UNIX Directories

ASSIGNMENT IS ASSOCIATED

WITH: UNIX Commands and Utilities (Chapter 9)

TIME REQUIRED: 2 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Create a tree directory complete with subdirectories and files.
2. Use the CHDIR to alternate between directories.
3. Add and delete subdirectories.
4. Add and delete files within subdirectories.
5. Trace a path within a subdirectory.
6. Change I/O permissions for files.

MATERIALS REQUIRED:

Text
UNIX manual
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
UNIX operating system

LABORATORY HANDOUTS:

1. Copy of DIRECTORY commands from UNIX manual.
2. Copy of LOGIN and LOGOUT procedures from UNIX manual.

LEARNING ACTIVITIES (assignments):

1. Load UNIX according to LOGIN procedures.
2. Create the specified subdirectories.
3. Add and delete the specified files under the appropriate subdirectories.
4. Establish and print I/O permissions for the files.
5. Print the resultant tree.
6. Draw the the resultant tree on plain white paper complete with root, subdirectories, and files.

STEPS:

1. Load UNIX into the microcomputer and perform LOGIN procedures.

2. Create the following subdirectories:

AP AR DP VP

3. Change to the "AP" subdirectory and add the following files using the VI COMMAND with <ESC> and <:WQ>:

PAYFILE PURCH PAYROL

4. Change to the "AR" subdirectory and add the files listed below:

INVOICES SALES RECVG

5. Change to the "VP" subdirectory and add the files listed below:

STOCK DIVID

6. Add the "OPER" subdirectory.

7. Change to the "DP" subdirectory and add the following files:

EQUIP MAINT SUPPLY

8. Print the contents of the TREE.

9. Remove the "OPER" subdirectory.

10. Change to the "DP" subdirectory and add the following files:

SYSTEMS DATA

11. Print the contents of the TREE.

12. Use the CHMOD command to allow the following permissions:

- A. All files under "AP" must allow reading, writing, but not executing.
- B. All files under "DP" must allow only reading.
- C. All files under "AR" must allow only writing.

- D. All files un "VP" must allow only reading.
- 10. List the contents of all the subdirectories with the accompanying permissions.

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Assignment #10

UNIT TITLE: Using the BOURNE SHELL of UNIX

ASSIGNMENT IS ASSOCIATED

WITH: UNIX (Chapter 16)

TIME REQUIRED: 2 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Have a basic understanding of UNIX BOURNE SHELL commands and processes.
2. Write programs in the command language and create files.

MATERIALS REQUIRED:

Text
UNIX MANUAL and handouts
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
UNIX software

LABORATORY HANDOUTS:

1. Sections from UNIX manual on commands, reading input, testing with IF..THEN..ELSE, assigning variable names, and looping.
2. UNIX LOGIN and LOGOUT procedures.

LEARNING ACTIVITIES (assignments):

1. Read information on the BOURNE SHELL from the UNIX manual or alternate text.
2. Create the input file either separately or interactively during the process.
3. Follow the pseudocode specifications to create the shell program.
4. Run the program and print the results.
5. Turn in the shell program, data, and results to the instructor.

STEPS:

1. Load the UNIX software.
2. Ensure that .PROFILE is on your UNIX diskette before continuing with the assignment.
3. Create a file called FILEA either separately or interactively containing 5 integers.
4. Create the program using the shell command language that follows the pseudocode listed below to find the largest number in the file:

BEGIN

Set the LOOP COUNTER to 1

Read in the first NUMBER from the file

Set the NUMBER to HIGH

While the LOOP COUNTER is less than 5

DO

 Read the next NUMBER

 IF the NUMBER is greater than HIGH
 THEN

 Set NUMBER to HIGH
 END IF

 Increment the LOOP COUNTER

END DO

Print and echo to the screen the largest number,
ie, HIGH

END.

5. Run the program. Turn in program, data file, and results into the instructor.

CST 2401: OPERATING SYSTEMS

STUDENT'S LABORATORY GUIDE

Assignment #11

UNIT TITLE: Reconfiguring the keyboard with PROKEY

ASSIGNMENT IS ASSOCIATED

WITH : Multiple-User Systems (Chapter 13)

TIME REQUIRED: 2 hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Create PROKEY macros which reconfigure the IBM PC's keyboard to suit the needs of the student.

MATERIALS REQUIRED:

Text
PROKEY manual or handouts
Word processor manual or handouts
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS operating system
PROKEY software
Word processor such as WORDSTAR or MULTIMATE

LABORATORY HANDOUTS:

1. Copy of PROKEY manual or handouts from manual on "macros".

LEARNING ACTIVITIES (assignments):

1. Design the keyboard of the PC to your personal needs.
2. Create the macro commands to perform the reconfiguring.

STEPS:

1. Load MS-DOS.
2. Be sure LAYOUT.COM is on your PROKEY diskette.

3. Type: LAYOUT.
4. Choose "C" from the displayed menu.
5. Type: IBM.LAY
6. Two keyboards will appear on the screen. One is for your reference, and the other displays changes as you make them.
7. To change the keyboard, use your arrow keys for positioning then press:

SPACE BAR	to change the key;
ESC	to cancel changes and reload;
ENTER	to save the new keyboard;
Q	to quit without saving.
8. After you have made all of the changes and have pressed <ENTER>, then save your changes in a file called:

TYPE:	filename.LAY
-------	--------------
9. In order to use the new keyboard, type "Y" after the prompt.
10. Print the new keyboard configuration.

CST 2401: OPERATING SYSTEMS

STUDENT'S LABORATORY GUIDE

Assignment #12

UNIT TITLE: Investigating Mainframe Operating Systems

ASSIGNMENT IS ASSOCIATED

WITH: Paging, Segmentation, and Virtual Memory
(Chapter 15)and Virtual Machines (Chapter 20)

TIME REQUIRED: 2 hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Code simple Job Control Language in order to understand the processes of a mainframe's operating system.
2. Decipher the output of a mainframe from a compilation, linking, and program execution process.

MATERIALS REQUIRED:

**The instructor may alter this assignment as per the requirements of the on-site mainframe computer and its operating system. The assignment is based on DOS JCL.

Mainframe computer and input unit of a card reader or CRT
Text

Compiler for the program, such as COBOL, FORTRAN, or
PASCAL

LABORATORY HANDOUTS:

Instructions on formulation of JCL for the on-site computer
Instructions for CRT or keypunch operations
Information on compiler and linker messages

LEARNING ACTIVITIES (assignments):

1. Code the high-level language program as per specifications.
2. Code the JCL as per specifications.
3. THE INSTRUCTOR MUST APPROVE THE JCL BEFORE IT CAN BE ENTERED AND EXECUTED ON THE MAINFRAME.
4. Run the job and turn in the results.

STEPS:

1. Write a high-level language program that performs the following tasks:
 - A. Reads in an unsorted data file from a card reader or CRT;
 - B. Sorts the file;
 - C. Loads the file to disk;
 - D. Prints the sorted file.
2. Code the JCL that accomplishes the tasks listed below:
 - A. Names the JOB LAB12;
 - B. Lists the options of: NODECK, LINK, and CATAL;
 - C. Calls in the appropriate compiler;
 - D. Uses /INCLUDE's to invoke the program and data;
 - E. LINK EDITS the modules;
 - F. Assigns the input to:
SYS001,SYSIPT
 - G. Assigns the output print to:
SYS002,SYSLST
 - H. Assigns the sorted disk output to:
DLBL SYS003,.....
EXTENT.....;
 - I. Uses END-OF-FILE and END-OF-JOB markers.

- J. Compiles and executes the program.
- 3. CHECK THE JCL WITH THE INSTRUCTOR.
- 4. Run the job.
- 5. Describe the printed output from the compiler and operating system and what information it provides in narrative form.

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Student's Laboratory Guide

Assignment #13

UNIT TITLE: Customizing the Operating System

ASSIGNMENT IS ASSOCIATED

WITH: Networks and Distributed Systems
(Chapter 21) and Data Base Systems
(Chapter 22)

TIME REQUIRED: 3 - 5 Hours

OBJECTIVES: Upon completion of this lab, the student will be able to:

1. Customize the operating system of his choice to his own specifications.
2. Use any combination of THE NORTON UTILITIES, SIDEKICK, or PROKEY to accomplish the desired result.

MATERIALS REQUIRED:

Text
SIDEKICK manual or handouts
Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD floppy disk
MS-DOS software or UNIX software
PROKEY manual or handouts
NORTON UTILITIES manual or handouts

LABORATORY HANDOUTS:

1. Sections from SIDEKICK, PROKEY, or NORTON UTILITIES as needed.
2. UNIX or MS-DOS commands.

LEARNING ACTIVITIES (assignments):

1. Decide upon the customization then turn it in to the instructor for approval.
2. Perform the customization.
3. Turn in results in printed form.
4. Turn in work disk.

STEPS:

1. Decide upon the operating system.
2. Design the customization and obtain instructor approval.
3. Perform the customization.
4. Print the results.
5. Turn in the results and work disk to the instructor.



**INSTRUCTOR'S COURSE
SYLLABUS**

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S COURSE SYLLABUS

COURSE TITLE: OPERATING SYSTEMS

COURSE NUMBER:

<u>CST</u>	<u>2401</u>	<u>3</u>	<u>2</u>	<u>4</u>
Prefix	No.	Lecture Hrs.	Lab Hrs.	Credit Hrs.

CATALOG DESCRIPTION:

An introduction to functional components of a computerized operating system. Topics include system structure, hardware usage, processing levels, resource utilization, scheduling discussions, dispatching, multitasking, and file management.

PREREQUISITES:

CSC 1301 -- INTRODUCTORY COMPUTING.

Basic principles of computing. Input/output media. Computer software, number systems, flowcharting and programming. Applications of computers in business and industry.

CSC 1305 -- LOGIC AND THEORY.

This course covers the classic, symbolic and mathematical elements of logic and their relations to computers and data processing logic and theory. Emphasis is placed on logic development through program flowcharts and structure charts.

TEXT:

Operating Systems: A Systematic View, by William S. Davis, Addison-Wesley Publishing Company, 1987.

- Teacher's Manual and Study Guide to accompany Operating Systems: A Systematic View, by William S. Davis, Addison-Wesley Publishing Company, 1987.

ALTERNATE TEXTS:

PC-DOS Introduction to High Performance Computing, by Peter Norton, Prentice Hall, 1985.

UNIX and XENIX: A Step-By-Step Guide, by Douglas W. Topham & Hai Van Truong, Brady Communications Company, Inc., 1985.

REFERENCES:

The Design and Construction of Compilers, by Robin Hunter, John Wiley & Sons, 1983.

Applying Data Structures, by T. G. Lewis & M. Z. Smith, Houghton Mifflin, 1982.

Computer Systems Architecture, by Jean-Loup Baer, Computer Science Press, 1980.

Disk Operating System Reference Manual, Version 2.0, 1st Ed., Microsoft Corp., 1993.

EQUIPMENT AND MATERIALS REQUIRED:

HARDWARE:

Microcomputer 2 disk drives and 640K per student.
One 5 1/4" SSDD floppy disk

SOFTWARE:

PROKEY software by Rosesoft and manual per student.

SIDEKICK software by Borland and manual per student.

The Norton Utilities software by Peter Norton and manual per student.

INSTRUCTIONAL PROCESS:

1. Lecture, discussion, and demonstration will be based upon the text and Instructor's Guide for each unit. Student's Lecture Guide provides outlines of lecture content, objectives, and requirements for each unit. Students should be encouraged to write definitions for vocabulary words provided in the Student's Lecture Guide.
2. Student's Laboratory Guides provide outlines of laboratory assignments, equipment and materials, and

steps to follow to complete each lab assignment. Equipment lists and additional information are also in the Instructor Lecture Guides.

3. Test and quizzes will be given periodically. (Sample test items can be found in accompanying teacher's manual.)
4. Homework will be assigned as necessary.

EVALUATION OF STUDENTS:

Examinations: Three unit exams and a final exam will be given during the semester. NO MAKE-UP EXAMS SHALL BE GIVEN WITHOUT PRIOR APPROVAL.

Quizzes: Quizzes will be administered periodically throughout the semester. NO MAKE-UP QUIZZES WILL BE GIVEN REGARDLESS OF REASON FOR ABSENCE.

Laboratory/
Homework: Assignments will generally be due at the end of the week. Late assignments will be accepted for one week after the due date with a 20% reduction in grade. After one week assignments will not be accepted.

FINAL GRADE DETERMINATION:

TESTS: four of equal weight (including the mid-term and the final) comprising 50% of the final grade.

QUIZZES: ten to fifteen of equal weight comprising 20% of the final grade.

LABS: nine to thirteen assignments of equal weight comprising 30% of the final grade.

COMPETENCY STATEMENTS:

Microcomputer Applications Program exit competencies upon which course is based:

Section I: Job Processing

A. Introduction/overview

1. Demonstrates a general knowledge of computer system analysis and design
2. Demonstrates a general knowledge of commercial application packages
3. Demonstrates a general knowledge of the need and development of operating systems
4. Demonstrates a general knowledge of evaluating operating systems
5. Demonstrates a general knowledge of operating system diagnostics
6. Demonstrates a general knowledge of operating system standards

B. Operating Systems

1. Understands MS-DOS and UNIX operating systems and how they are used
2. Demonstrates the ability to configure an operating system
3. Demonstrates the ability to use PROKEY software
4. Demonstrates the ability to use SIDEKICK software

SECTION II: Hardware Operations

A. Data Processing Equipment

1. Oversees loading of appropriate operating system
2. Loads, starts, and unloads disk drives
3. Interprets and applies instructions from written procedures
4. Keeps logs of runs and job status
5. Keeps logs of equipment problems
6. Follows proper security, emergency, and backup procedures
7. Recovers data after power failure
8. Notifies supervisors or management of machine failure or processing problems
9. Performs minor maintenance on microcomputers
10. Verifies quality of microcomputer output

B. Peripheral Equipment

1. Performs power-up-down procedures for peripheral equipment
2. Performs routine maintenance on peripheral devices
3. Operates printer

4. Sets up printer with continuous forms, single pages, etc
5. Removes printed data output
6. Operates external random disk (hard disk, video disk, etc.)

C. Emergency Procedures

1. Performs hardware recovery operations
2. Performs emergency backups and power downs

SECTION III: Supervisory Functions

A. Product Control

1. Enforces microcomputer security program (control of data)
2. Creates command files to control data security

B. Equipment Operations

1. Assists with selection and purchasing of data processing equipment
2. Consults with systems designers on programming requirements of new systems (software and hardware)
3. Defines systems interface or integration requirements
4. Recommends modification of systems to management and/or users
5. Estimates systems requirements and capabilities
6. Determines system scheduling and job priorities

SECTION IV: Housekeeping Functions, Routine

A. Routine Maintenance of Equipment

1. Inspects diskettes and hard disk for damage
2. Loads paper in printer
3. Verifies diagnostic tests

B. Records Maintenance

1. Maintains integrity and confidentiality of data
2. Maintains an operation log of microcomputer operation
3. Maintains files or reports, regulations, or directives pertaining to data
4. Maintains backup procedure reports and records

5. Reviews and evaluates output and reports for accuracy
6. Recognizes errors in other than keyed data
7. Initiates corrections of discovered errors
8. Organizes files of job instructions
9. Requisitions and maintains inventory of data processing supplies

COURSE OUTLINE:

CONTENTS OF CHAPTER 1: Introduction to Operating Systems

1. What is an Operating System?
2. Why Study Operating Systems?
3. An Overview of the Text
4. Assumed Background

CONTENTS OF CHAPTER 2: Hardware

1. Main memory
 - A. Physical Memory Devices
 - B. Addressing Memory
2. The Processor
 - A. Machine cycles
3. Input and Output Devices
4. Secondary Storage
 - A. Diskette
 - B. Hard Disk
 - C. Other Secondary Media
 - D. Accessing Secondary Storage
5. Linking the Components

CONTENTS OF CHAPTER 3: Software and Data

1. Hardware and Software
2. Software
 - A. Instructions
 - B. Programming Languages
 - C. Libraries
 - D. Reentrant Code

3. Data

- A. Data Management
- B. Data Elements
- C. Data Structures
- D. Access Techniques
- E. Data Base Management

CONTENTS OF CHAPTER 4: Linking the Components

- 1. Linking Internal Components
 - A. Bus Lines
 - B. Word Sizes
- 2. Machine Cycles
- 3. Architectures
 - A. Single-bus Architecture
 - B. Interfaces
 - C. Channels and Control Units
 - D. Multiple-bus Architecture
- 4. Logical and Physical I/O
 - A. Primitives
 - B. Open
 - C. Accessing Data

CONTENTS OF CHAPTER 5: Single-user Systems

- 1. The Single-User Environment
- 2. Communications with the User
 - A. The Command Processor
 - B. The Command Language
 - C. Shells
- 3. Communicating with the Hardware
 - A. The Input/Output Control System
 - B. The File System
 - C. Memory Allocation
 - D. Interrupts
- 4. The Boot

- 5. Efficiencies
 - A. Speed Disparity
 - B. Scheduling
 - C. Other Run-Time Savings
- 6. Utilities

CONTENTS OF CHAPTER 6: Multiple-User Systems

- 1. The Multiple-user Environment
- 2. Multiprogramming
 - A. Memory Management
 - B. Managing Processor Time
 - D. Interrupts
 - E. Peripheral Device Allocation
 - F. Spooling
 - G. A Multiprogramming Operating System
- 3. Time-Sharing
 - A. Roll-in/Roll-out
 - B. Time-Slicing
 - C. Time-Sharing and Interrupts
 - D. Allocating External Devices
 - E. External Priority
- 4. Driving an Operating System

CONTENTS OF CHAPTER 7: Command Languages

- 1. Command Language Functions
 - A. Identifying Users
 - B. Identifying Programs
 - C. Specifying Device Requirements
 - D. Run-Time Intervention
- 2. Source of Commands
- 3. Learning Command Language

CONTENTS OF CHAPTER 8: MS-DOS Commands

- 1. MS-DOS
- 2. Getting Started
 - A. Formatting a Disk

3. The File System
 - A. File Names
 - B. Directories
 - C. Path Names
 - D. Viewing a Directory
 - E. Creating Directories
 - F. Creating Files
 - G. Changing Directories
 - H. Manipulating Files
4. Pipes, Filters, and Redirection
5. Batch Files
6. Other Useful Commands

CONTENTS OF CHAPTER 14: MS-DOS

1. Evaluating an Operating System
 - A. Measures of Effectiveness
 - B. System Objectives
2. Microcomputer Operating Systems
 - A. The Microcomputer Environment
 - B. Basic Operating System Functions
3. MS-DOS Internals
 - A. The Shell
 - B. Accessing Peripherals
 - C. The File System
 - D. Interrupt Processing
 - E. Booting MS-DOS
 - F. Running MS-DOS

CONTENTS OF CHAPTER 9: UNIX Commands and Utilities

1. UNIX
2. Logging On
3. The File System
 - A. File Names
 - B. Directories
 - C. Pathnames
 - D. Viewing a Directory

- E. Creating Directories
 - F. Changing Working Directories
 - G. Creating Files
 - H. Manipulating Files
- 4. Pipes, Filters, and Redirection
 - 5. Shell Scripts
 - 6. Other Useful Commands

CONTENTS OF CHAPTER 16: UNIX Internals

- 1. The UNIX System
- 2. Images and Processes
 - A. Process Creation
 - B. Initialization
 - C. Process Management
- 3. The Shell
- 4. Time-slicing and Interrupts
- 5. Memory Management
 - A. Swapping (or paging)
 - B. Memory Space and Reentrant Code
- 6. The File System
 - A. Accessing Disk Files
- 7. Managing Disk Space
- 8. Buffering
- 9. UNIX Internals

CONTENTS OF CHAPTER 13: Libraries and the Linkage Editor

- 1. Program Libraries
 - A. Compile, Link, Edit, and Execute
- 2. Compilers and Source Statement Libraries
 - A. Creating a Library
 - B. Adding Members to a Library
 - C. Using Private Source Statement Libraries

- 3. Object Modules
 - A. Creating an Object Module Library
 - B. Adding Object Modules to a Library
- 4. Load Modules
 - A. The Linkage Editor
 - B. The Primary Object Module
 - C. System Libraries
 - D. Private Libraries
 - E. Load Module Libraries
- 5. The Loader

CONTENTS OF CHAPTER 15: Segmentation, Paging, and Virtual Memory

- 1. Memory Utilization
- 2. Address Translation
- 3. Segmentation
 - A. Translating Segment Addresses
 - B. Addressing the Operating System
 - C. Segmentation and Memory Management
- 4. Paging
 - A. Paging and Memory Management
- 5. Segmentation and Paging
- 6. Virtual Memory
 - A. Addressing Virtual Memory
 - B. Virtual-Equals-Real Area
 - C. Thrashing
 - D. Implementing Virtual Memory
 - E. Why Virtual Memory

CONTENTS OF CHAPTER 20: Virtual Machines

- 1. Operating System Development
 - A. The Virtual Machine Concept
 - B. VM/SP
- 2. VM's Structure
 - A. CMS

3. The Control Program (CP)
 - A. Processor Management
 - B. Memory Management
 - C. Managing Peripheral Devices
 - D. Principles of Operation
4. A New Standard

CONTENTS OF CHAPTER 21: Networks and Distributed Systems

1. Why Distributed Systems?
2. Data Communication
 - A. Analog and Digital
 - B. Communication Media
 - C. Switching
 - D. Protocols
3. Communications with a Single Mainframe
4. Networks
 - A. Network Configuration
 - B. Network Operating Systems
 - C. The Future of Networks

CONTENTS OF CHAPTER 22: Data Base Systems

1. The Evolution of System Software
2. Traditional Data Management
 - A. Custom Files
 - B. Data Redundancy
 - C. Data Ownership
 - D. Data Dependency
3. The Central Data Base Approach
 - A. Data Integrity
 - B. Data as a Resource
 - C. Data-Independent Software
 - D. Advantages and Disadvantages
4. Implementing a Data Base
 - A. Data Base Organization
 - B. The Data Base Management System
5. Software Migration



INSTRUCTOR'S GUIDE

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 1

CHAPTER TITLE: Introduction to Operating Systems

CONTENTS OF CHAPTER:

1. What is an Operating System?
2. Why Study Operating Systems?
3. An Overview of the Text
4. Assumed Background

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Define an operating system.
2. Describe why operating systems are studied.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text

Study Guide

Student's Lecture Guide (Chapter 1)

Laboratory:

None

PROCEDURES:

Lecture:

Lecture

Laboratory:

None

LEARNING ACTIVITIES:

Lecture:

Read Chapter 1

Answer Chapter 1 questions from Study Guide

Laboratory:

None

EVALUATION:

Lecture: None

Laboratory: None

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 2

CHAPTER TITLE: Hardware

CONTENTS OF CHAPTER:

1. Main Memory
 - A. Physical Memory Devices
 - B. Addressing Memory
2. The Processor
 - A. Machine Cycles
3. Input and Output Devices
4. Secondary Storage
 - A. Diskette
 - B. Hard Disk
 - C. Other Secondary Media
 - D. Accessing Secondary Storage
5. Linking the Components

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the internal manipulations of binary data and instructions.
2. Identify the types of physical memory and their components.
3. Describe addressing techniques in main memory.
4. Identify and define the components of the processor.
5. Describe the processes within a machine cycle.
6. Identify and describe the purpose of registers.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text

Study Guide
Student's Lecture Guide (Chapter 2)

Laboratory:

Student's Laboratory Guide (Lab 1)

Hardware:

Microcomputer with 640K and two disk drives per
student
One 5 1/4" SSDD diskette

Software:

MS-DOS operating system diskette

PROCEDURES:

Lecture:

Lecture
Demonstration

Laboratory:

Demonstration
Assign Lab #1

LEARNING ACTIVITIES:

Lecture:

Read Chapter 2 in text
Answer Chapter 2 questions from Study Guide

Laboratory:

Complete LAB #1

EVALUATION:

Lecture: Quiz #1 (objective)

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 3

CHAPTER TITLE: Software and Data

CONTENTS OF CHAPTER:

1. Hardware and software
2. Software
 - A. Instructions
 - B. Programming Languages
 - C. Libraries
 - D. Re-entrant Code
3. Data
 - A. Data Management
 - B. Data Elements
 - C. Data Structures
 - D. Access Techniques
 - E. Data Base Management

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the parts of an instruction.
2. Distinguish among an assembler, a compiler, and an interpreter.
3. Define a library and its purposes.
4. Distinguish among a source module, an object module, and a load module.
5. Describe the different type of data elements.
6. Describe the different type of data structures.
7. Define the relative record concept.
8. Distinguish between sequential and direct access.
9. Define a data base and state its uses.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Study Guide

Student's Lecture Guide (Chapter 3)

SIDEKICK manual or handout on NOTEPAD and CALCULATOR

Laboratory:

Student's Laboratory Guide (Lab 2)

Hardware:

Microcomputer with 640K and two disk drives per
student
One 5 1/4" SSDD diskette

Software:

MS-DOS operating system
SIDEKICK software

LEARNING ACTIVITIES:

Lecture:

Read Chapter 3 in text
Answer Chapter 3 questions from Study Guide

Laboratory:

Complete Lab #2

EVALUATION:

Lecture: Quiz #2 (objective)

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 4

CHAPTER TITLE: Linking the Components

CONTENTS OF CHAPTER:

1. Linking Internal Components
 - A. Bus Lines
 - B. Word Size
2. Machine Cycles
3. Architectures
 - A. Single-Bus Architecture
 - B. Interfaces
 - C. Channels and Control Units
 - D. Multiple-Bus Architecture
4. Logical and Physical I/O
 - A. Primitives
 - B. Open
 - C. Accessing data

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe how the internal components of a computer are physically linked.
2. Describe how the word size affects the processing speed, precision, memory capacity, and instruction set size.
3. Describe a motherboard, a slot, and a bus.
4. Distinguish between single-bus and multiple-bus architecture.
5. Define a primitive operation.
6. Distinguish between logical and physical I/O.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 4)

Laboratory:

Student's Laboratory Guide (Lab 3)

Hardware:

Microcomputer without monitor or keyboard
Screwdriver
Template

Software:

None

PROCEDURES:

Lecture:

Lecture
Demonstration of PC internals

Laboratory:

Assign Lab 3

LEARNING ACTIVITIES:

Lecture:

Read Chapter 4 in text
Answer Chapter 4 questions from Study Guide

Laboratory:

Complete Lab #3

EVALUATION:

Lecture: Quiz #3 (objective)

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 5

CHAPTER TITLE: Single-user Systems

CONTENTS OF CHAPTER:

1. The Single-User Environment
2. Communicating with the User
 - A. The Command Processor
 - B. The Command Language
 - C. Shells
3. Communicating with the Hardware
 - A. The Input/Output Control System
 - B. The File System
 - C. Memory Allocation
 - D. Interrupts
4. The Boot
5. Efficiencies
 - A. Speed Disparity
 - B. Scheduling
 - C. Other Run-Time Savings
6. Utilities

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the single-user environment.
2. Define the three common modules: the command processor, the I/O control system, and the file system.
3. Define a command language.
4. Define a batch command file.
5. Distinguish between a standard shell and a custom shell.
6. Define the functions of the I/O control system.
7. Define the functions of the file system.
8. Distinguish between resident and transient modules.
9. Define overlay structures.

10. Define interrupt, boot, and speed disparity.
11. Define multiple buffering.
12. Describe the function of utilities.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 5)

Laboratory:

Student's Laboratory Guide (Lab 4)

Hardware:

Microcomputer with 640K and two disk drives
One 5 1/4" SSDD diskette

Software:

MS-DOS operating system
SIDEKICK software

PROCEDURES:

Lecture:

Lecture
Demonstration on ASCII TABLE and DEBUG

Laboratory:

Assign Lab 4

LEARNING ACTIVITIES:

Lecture:

Read Chapter 5 in text
Answer Chapter 5 questions from Study Guide

Laboratory:

Complete Lab #4

EVALUATION:

Lecture: Quiz #4 (objective)

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 6

CHAPTER TITLE: Multiple-user Systems

CONTENTS OF CHAPTER:

1. The Multiple-User Environment
2. Multiprogramming
 - A. Memory Management
 - B. Managing Processor Time
 - C. Interrupts
 - D. Peripheral Device Allocation
 - E. Scheduling and Queuing
 - F. Spooling
 - G. A Multiprogramming Operating System
3. Time-Sharing
 - A. Roll-in/Roll-out
 - B. Time-Slicing
 - C. Time-Sharing and Interrupts
 - D. Allocating External Devices
 - E. External Priority
4. Driving an Operating System

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the effectiveness of the pool-driven time-sharing operating system and the interrupt-driven multiprogramming operating system.
2. Distinguish among the four types of memory management: fixed-partition, dynamic, segmentation, and paging.
3. Explain how the queuing routines and the scheduler work together to load application programs.
4. Define throughput and turnaround time.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text

Study Guide

Student's Lecture Guide (Chapter 6)

Laboratory:

Student's Laboratory Guide (Lab 5)

Hardware:

Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD diskette

Software:

PROKEY manual or handouts
PROKEY software
MS-DOS operating system

PROCEDURES:

Lecture:

Lecture
Demonstration on PROKEY capabilities

Laboratory:

Assign Lab #5

LEARNING ACTIVITIES:

Lecture:

Read Chapter 6 in text
Answer Chapter 6 questions in Study Guide

Laboratory:

Complete Lab #5

EVALUATION:

Lecture: Quiz #5 (objective)

Laboratory: Lab Quiz on Prokey functions (objective)

CST 2401: OPERATING SYSTEMS

INSTRUCTOR'S LECTURE GUIDE

Chapter 7

CHAPTER TITLE: Command Languages

CONTENTS OF CHAPTER:

1. Command Language Functions
 - A. Identifying Users
 - B. Identifying Programs
 - C. Specifying Device Requirements
 - D. Run-Time Intervention
2. Sources of Commands
3. Learning Command Language

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Distinguish between interactive and batch commands.
2. Define the command language functions.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 7)

Laboratory:

Student's Laboratory Guide (Lab 6)

Hardware:

Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD diskette

Software:

NORTON UTILITIES diskette
MS-DOS operating system

PROCEDURES:

Lecture:

Lecture

Discussion on the NORTON UTILITY package

Laboratory:

Assign Lab 6

LEARNING ACTIVITIES:

Lecture:

Read Chapter 7 in text

Answer Chapter 7 questions from Study Guide

Laboratory:

Complete Lab #6

EVALUATION:

Lecture:

Quiz #6 (objective)

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Chapter 8

CHAPTER TITLE: MS-DOS Commands

CONTENTS OF CHAPTER:

1. MS-DOS
2. Getting started
 - A. Formatting a Disk
3. The File System
 - A. File Names
 - B. Directories
 - C. Path Names
 - D. Viewing a Directory
 - E. Creating Directories
 - F. Creating Files
 - G. Changing Directories
 - H. Manipulating Files
4. Pipes, Filters, and Redirection
5. Batch Files
6. Other Useful Commands

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the general form of an MS-DOS command.
2. Format a floppy disk.
3. Distinguish between the two types of directory structures: simple linear and hierarchical.
4. Distinguish between a path name and a file name.
5. Distinguish between a root directory and a working directory.
6. Define redirection and state its uses.
7. Describe the functions of filters and pipes.
8. Create an AUTOEXEC.BAT file.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 8)

Laboratory:

Student's Laboratory Guide (Lab 7)

Hardware:

Microcomputer with 640K and two disk drives per
student
One 5 1/4" SSDD diskette

Software:

MS-DOS software

PROCEDURES:

Lecture:

Lecture
Demonstration on MS-DOS capabilities
Discussion

Laboratory:

Assign Lab #7

LEARNING ACTIVITIES:

Lecture:

Read Chapter 8 in text
Answer Chapter 8 questions in Study Guide

Laboratory:

Complete Lab #7

EVALUATION:

Lecture: Quiz #7 (objective)

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Chapter 14

CHAPTER TITLE: MS-DOS

CONTENTS OF CHAPTER:

1. Evaluating an Operating System
 - A. Measures of Effectiveness
 - B. System Objectives
2. Microcomputer Operating Systems
 - A. The Microcomputer Environment
 - B. Basic Operating System Functions
3. MS-DOS Internals
 - A. The Shell
 - B. Accessing Peripherals
 - C. The File System
 - D. Interrupt Processing
 - E. Booting MS-DOS
 - F. Running MS-DOS

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the hardware environment of a typical microcomputer system.
2. Describe the criteria for measuring the effectiveness of a microcomputer.
3. Relate the functions of COMMAND.COM to the general function of a command processor or shell.
4. Describe the functions of IO.SYS and MSDOS.SYS.
5. Define a device driver.
6. Define an interrupt.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 14)

Laboratory:

Student's Laboratory Guide (Lab #8)

Hardware:

Microcomputer with 640K and two disk drives per
student
One 5 1/4" SSDD diskette

Software:

MS-DOS diskette

PROCEDURES:

Lecture:

Lecture
Demonstration on batch files

Laboratory:

Assign Lab #8

LEARNING ACTIVITIES:

Lecture:

Read Chapter 14 in text
Answer Chapter 14 questions in Study Guide

Laboratory:

Complete Lab #8

EVALUATION:

Lecture: Quiz #8 (objective)

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Chapter 9

CHAPTER TITLE: UNIX Commands and Utilities

CONTENTS OF CHAPTER:

1. UNIX
2. Logging On
3. The File System
 - A. File Names
 - B. Directories
 - C. Pathnames
 - D. Viewing a Directory
 - E. Creating Directories
 - F. Changing Working Directories
 - G. Creating Files
 - H. Manipulating Files
4. Pipes, Filters, and Redirection
5. Shell Scripts
6. Other Useful Commands

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the general form of a UNIX command.
2. Distinguish between the MS-DOS and the UNIX operating systems.
3. Compare a shell script to an MS-DOS batch file.
4. Distinguish between the two types of directory structures: simple linear and hierarchical.
5. Distinguish between a path name and a file name.
6. Distinguish between the root directory and a working directory.
7. Describe the functions of redirection.
8. Describe the functions of filters and pipes.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 9)

Laboratory:

Student's Laboratory Guide (Lab #9)

Hardware:

Microcomputer with 640K and two disk drives per
student
One 5 1/4" SSDD diskette

Software:

UNIX diskette

PROCEDURES:

Lecture:

Lecture
Demonstration on UNIX directories

Laboratory:

Assign Lab #9

LEARNING ACTIVITIES:

Lecture:

Read Chapter 9 in text
Answer Chapter 9 questions from Study Guide

Laboratory:

Complete Lab #8

EVALUATION:

Lecture: Quiz #9 (objective)

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Chapter 16

CHAPTER TITLE: UNIX Internals

CONTENTS OF CHAPTER:

1. The UNIX System
2. Images and Processes
 - A. Process Creation
 - B. Initialization
 - C. Process Management
3. The Shell
4. Time-Slicing and Interrupts
5. Memory Management
 - A. Swapping (or paging)
 - B. Memory Space and Reentrant Code
6. The File System
 - A. Accessing Disk Files
7. Managing Disk Space
8. Buffering
9. UNIX Internals

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Define shell and kernel.
2. Describe the portability of UNIX.
3. Distinguish between an image and a process.
4. Explain how processes are created under UNIX.
5. Describe fork primitive creation and its varied results.
6. Explain UNIX dispatching.
7. Distinguish between an event and a process.
8. Explain the linking process between UNIX and a peripheral device.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 16)

Laboratory:

Student's Laboratory Guide (Lab #10)

Hardware:

Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD diskette

Software:

UNIX diskette

PROCEDURES:

Lecture:

Lecture
Demonstration UNIX directories
Discussion

Laboratory:

Assign Lab #10

LEARNING ACTIVITIES:

Lecture:

Read Chapter 16 in text
Answer Chapter 16 questions from Study Guide

Laboratory:

Complete Lab #10

EVALUATION:

Lecture: Quiz #10 (objective)

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Chapter 13

CHAPTER TITLE: Libraries and the Linkage Editor

CONTENTS OF CHAPTER:

1. Program Libraries
 - A. Compile, Link, Edit, and Execute
2. Compilers and Source Statement Libraries
 - A. Creating a Library
 - B. Adding Members to a Library
 - C. Using Private Source Statement Libraries
3. Object Modules
 - A. Creating an Object Module Library
 - B. Adding Object Modules to a Library
4. Load Modules
 - A. The Linkage Editor
 - B. The Primary Object Module
 - C. System Libraries
 - D. Private Libraries
 - E. Load Module Libraries
5. The Loader

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Explain how a compiler or an assembler incorporates source statement library members into a source module.
2. Distinguish between a system library and a private library.
3. Describe the purpose of the linkage editor.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 13)

Laboratory:

Student's Laboratory Guide (Lab #11)

Hardware:

Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD diskette

Software:

PROKEY diskette

PROCEDURES:

Lecture:

Lecture
Demonstration on PROKEY customizing features

Laboratory:

Assign Lab #11

LEARNING ACTIVITIES:

Lecture:

Read Chapter 13 in text
Answer Chapter 13 questions from Study Guide

Laboratory:

Complete Lab #11

EVALUATION:

Lecture: Quiz #11 (objective)

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Chapter 15

CHAPTER TITLE: Segmentation, Paging, and Virtual Memory

CONTENTS OF CHAPTER:

1. Memory Utilization
2. Address Translation
3. Segmentation
 - A. Translating Segment Addresses
 - B. Addressing the Operating System
 - C. Segmentation and Memory Management
4. Paging
 - A. Paging and Memory Management
5. Segmentation and Paging
6. Virtual Memory
 - A. Addressing Virtual Memory
 - B. Virtual-Equals-Real Area
 - C. Thrashing
 - D. Implementing Virtual Memory
 - E. Why Virtual Memory?

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Distinguish fixed-partition memory management, dynamic memory management, segmentation, paging, and virtual memory.
2. Distinguish between relative and absolute addresses.
3. Explain address translation.
4. Explain segmentation and dynamic translation.
5. Explain how memory space is managed under segmentation.
6. Explain paging.
7. Explain how main memory space is managed under paging.
8. Discuss the advantages and disadvantages associated with segmentation, paging, and segmentation and paging.
9. Explain virtual memory.

10. Distinguish between virtual and real addresses.
11. Distinguish between demand paging and prepaging.
12. Explain the significance of the virtual-equals-real area.
13. Explain thrashing.
14. Describe how virtual memory systems are physically implemented.
15. Explain how virtual memory serves as a model of a complex address space.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 15)
Discussion on mainframe memory management

Laboratory:

* Set by instructor due to variety of mainframes
Mainframe
Student's Laboratory Guide (Lab #12)

PROCEDURES:

Lecture:

Read Chapter 15 in text
Answer Chapter 15 questions from Study Guide
Demonstration of mainframe's operating system

Laboratory:

Assign Lab #12

CHAPTER EVALUATION:

Lecture: Quiz #12 (objective)

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Chapter 20

CHAPTER TITLE: Virtual Machines

CONTENTS OF CHAPTER:

1. Operating System Development
 - A. The Virtual Machine Concept
 - B. VM/SP
2. VM's Structure
 - A. CMS
3. The Control Program (CP)
 - A. Processor Management
 - B. Memory Management
 - C. Managing Peripheral Devices
 - D. Principles of Operation
4. A New Standard

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe the ideal program development environment.
2. Explain the virtual machine concept.
3. Explain transparency.
4. Explain why IBM developed VM/SP.
5. Distinguish between a real operating system and a virtual operating system.
6. Briefly describe the structure of a VM system.
7. Explain how the control program simulates the operation of a real computer for its virtual operating systems.
8. Describe the functions performed by CMS.
9. Explain how CP manages processor time and allocates main memory space.
10. Explain how CP manages access to peripheral devices.
11. Explain the minidisk concept.
12. Briefly describe the control program's principles of operation.
13. Discuss the advantages and disadvantages of VM.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 20)

Laboratory:

None

PROCEDURES:

Lecture:

Read Chapter 20 in text
Answer Chapter 20 questions from Study Guide

Laboratory:

None

CHAPTER EVALUATION:

Lecture: Quiz #13 (objective)

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Chapter 21

CHAPTER TITLE: Networks and Distributed Systems

CONTENTS OF CHAPTER:

1. Why Distributed Systems?
2. Data Communication
 - A. Analog and Digital
 - B. Communication Media
 - C. Switching
 - D. Protocols
3. Communicating with a Single Mainframe
4. Networks
 - A. Network Configurations
 - B. Network Operating Systems
 - C. The Future of Networks

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Define a network.
2. Distinguish between local and remote data communication.
3. Distinguish between analog and digital data.
4. Describe circuit switching, message switching, and packet switching.
5. Define a protocol.
6. Distinguish between computer networks and local area networks.
7. Distinguish among the four types of networks: hierarchical, star, ring, and multiple-user bus.
8. Distinguish between distributed and network operating systems.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text
Study Guide
Student's Lecture Guide (Chapter 21)

Laboratory:

Student's Laboratory Guide (Lab 13)

Hardware:

Microcomputer with 640K and two disk drives per student
One 5 1/4" SSDD diskette

Software:

MS-DOS or UNIX
PROKEY
SIDEKICK
NORTON UTILITES

PROCEDURES:

Lecture:

Read Chapter 21 in text
Answer Chapter 21 questions from Study Guide

Laboratory:

Complete Lab #13

EVALUATION:

Lecture: Quiz #14 (objective)

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Chapter 22

CHAPTER TITLE: Data Base Systems

CONTENTS OF CHAPTER:

1. The Evolution of System Software
2. Traditional Data Management
 - A. Custom Files
 - B. Data Redundancy
 - C. Data Ownership
 - D. Data Dependency
3. The Central Data Base Approach
 - A. Data Integrity
 - B. Data as a Resource
 - C. Data-Independent Software
 - D. Advantages and Disadvantages
4. Implementing a Data Base
 - A. Data Base Organization
 - B. The Data Base Management System
5. Software Migration

CHAPTER OBJECTIVES: Upon completion of this chapter, the student will be able to:

1. Describe how data redundancy affects data integrity.
2. Describe how a data base minimizes data dependency.
3. Explain the functions of a well-designed data base.
4. Explain how pointers and indexes are used to line the elements in a data base.

EQUIPMENT AND MATERIALS REQUIRED:

Lecture:

Text

Study Guide

Student's Lecture Guide (Chapter 22)

Laboratory:
None

PROCEDURES:

Lecture:

Lecture
Read Chapter 22 in text
Answer Chapter 22 questions from Study Guide

Laboratory:

None

EVALUATION:

Lecture: Quiz #15 (objective)